

3.0 NATURE OF CONTAMINATION

3.1 Soils and Sediments

Sediment samples from potential depositional zones located between Upriver Dam (RM 80 and RM 81.5) and near an island locally known as “Donkey Island” (RM 83.25 to 83.75) were collected and analyzed to complete characterization of the nature and extent of PCB sediment contamination at the Site. Potential depositional zones were identified based upon field inspections, the results of the bathymetric survey, bottom profiling, and structure profiling. Sediment samples from a total of 22 locations were collected and analyzed for chemicals of potential concern (COPCs). In late May 2003, Bluewater Engineering performed a combined bathymetric and sediment texture profiling survey within target depositional areas of the Site.

The sediment classification survey identified a total of four potentially fine-grained sediment deposits within the Site having a continuous dimension in any direction of 50 feet or greater, or a minimum surface area of 250 square feet. These four areas are located along inner bends of the Spokane River channel or in off-channel embayments (e.g., near Donkey Island) where sediment deposition may be focused in such a fluvial system. Initial investigation of the four areas thought to potentially contain fine-grained sediments and associated PCBs enabled the exclusion of one of the areas based on bathymetric survey results and observation of photographic transects of the study areas.

The objective of the focused sediment sampling activities was to investigate other depositional areas immediately upstream of the Upriver Dam apron in order to determine if surface sediments in such depositional areas contained hazardous concentrations of PCBs. Based on the bathymetric survey and video transect of the four suspect deposits, sediment samples from three areas were analyzed for PCBs. In order to characterize the extent of PCB contamination, sediment cores were used to profile the PCBs in the largest deposit (Figure 2).

Sediment samples from the three remaining areas suspected of containing PCB contaminants were collected in June and July of 2003. Additional sampling efforts were conducted in July 2004 to further delineate the contaminated sediment deposits identified by earlier sampling events. Specifically, sediment samples were collected from the large deposit immediately upstream of the dam, the two backwater channels of Donkey Island, and a small deposit on the south side of the riverbed. Three deposits suspected of containing elevated PCBs were evaluated in the Site's RI. Sampling efforts enabled Ecology to select the deposits with elevated PCB levels. Two of the three deposits sampled contained PCB concentrations exceeding Ecology's selected cleanup levels discussed in Section 5.3.

These two contaminated deposits are discussed below and depicted in Figure 3.

Deposit 1 – approximately 3.7 acres in deep water (20 to 25 feet below normal pool level) zones near Upriver Dam (approximately RM 80.1 to 80.6), containing dry-weight (dw) surface sediment PCB concentrations up to 1,430 µg/Kg dw. Sub-surface sediments within the deposit contain PCBs at concentrations reaching 20 mg/Kg. The contaminated sediments have accumulated in a channel depression formed by the river prior to the construction of the Upriver Dam. Preliminary ownership determinations at Deposit 1 indicate that portions of the deposit or land adjacent to the deposit along the bank are owned by the City of Spokane, while the principal underwater sediments of concern are believed to be located within the bed and banks of the

Spokane River owned by the state of Washington, under the control of the Department of Natural Resources.

Deposit 2 – a smaller (0.2 acre) shallow water area on north bank side channels near Donkey Island (RM 83.4), containing surface sediment PCB concentrations up to 330 µg/Kg dw. The upland area is owned by the WA Dept. of Parks and Recreation. Some submerged portions, as bed and bank of the Spokane River, may be owned by the state of Washington, under the control of the Department of Natural Resources. Donkey Island is valuable riparian habitat that provides shelter for juvenile salmonids. The island is a highly heterogeneous environment consisting of areas that are only seasonally inundated as well as channels which have standing water throughout the year. The proximity of the two backwater channels to known spawning areas for trout and other species enhances the ecological importance of this area. The remedial action proposed in this FCAP accounts for the importance of this riparian habitat.

3.2 Surface Water

Water column PCB concentrations at the Site were characterized by direct collection of surface water samples, as well as Semi-Permeable Membrane Device (SPMD) deployments. SPMD technology is based on rate-controlled chemical partitioning from the water column to enclosed neutral lipid materials, and can be used to mathematically extrapolate modeled steady-state water concentrations of dissolved organic chemicals such as PCBs (Huckins et al. 1993 and 2002). The results of the direct sampling and SPMD estimates of seasonal surface-water PCB concentrations are summarized in the section below.

3.2.1 Water Chemistry Results

Total PCB concentrations in surface water were measured at the Site in early September 2003 during low flow conditions of nearly 500 cubic feet per second (cfs), measured at the Spokane gage. The RI used two methods to calculate PCB concentrations in the water column. Chemistry results were reported as EPA-method blank-qualified and blank-corrected values. PCBs reached a maximum concentration of approximately 120 picograms per liter (pg/L) at Boulder Beach at RM 82. Based on EPA-method blank-qualified results, surface water PCB concentrations measured at the Site were below the current surface water quality standard of 170 pg/L, WAC 173-201A, though samples collected during September at Boulder Beach and at the Upriver Dam forebay (RM 79.8) exceeded EPA's 2002 recommended water quality criterion for total PCBs of 64 pg/L and the alternative blank-corrected method indicated that concentrations were greater than 170 pg/L. Under MTCA, the National Recommended Water Quality Criterion for PCBs of 64 pg/L must be considered since it is recognized as an applicable, relevant, and appropriate requirement (ARAR). A narrative discussion of the nature and extent of water column total PCB concentrations at the Site which ranged from 14 to roughly 120 pg/L is provided below.

In September 2003, the highest validated total PCB concentration (approximately 120 pg/L) was detected in the surface water sample collected from Boulder Beach (RM 82), located upstream of Deposit 1. The surface water sample collected further downstream in the Upriver Dam Forebay (RM 79.8) also contained a similar total PCB concentration (approximately 110 pg/L). Conversely, water samples collected at and above the upstream Site boundary at Plante's

Ferry Park (RM 84.6) and Barker Road (RM 90.4), respectively, both contained lower total PCB concentrations (14 to 17 pg/L). Much of the apparent increase in total PCB concentrations between Plante's Ferry Park and Boulder Beach was attributable to PCB-11. Increases in bottom water concentrations of certain PCB homologue groups (e.g., tetrachlorobiphenyls) near the Dam Forebay were potentially attributable to sediment-associated releases from deposits near the dam (primarily between RM 80.1 and 80.6).

In December 2003, all validated PCB results were relatively low, compared with those during the September 2003 sampling. Total PCB concentrations in surface water samples collected during December ranged from 15 to 29 pg/L, based on EPA qualified results, and there were no noticeable trends in the data. Based on the available data, the apparent seasonal increase in total PCB concentrations observed during September 2003 is indicative of surface water releases of predominantly PCB-11 to the river system between Plante's Ferry Park and Boulder Beach apparently from treated wastewater discharged from the Inland Empire Paper outfall (Ecology 2002). The apparent increase in certain PCB homologue groups in deep-water samples collected between Boulder Beach and the Dam Forebay may be the result of a release of PCBs from Deposit 1. Based on chemical analysis performed on the sediment in each deposit, PCBs from Deposit 2 may also contribute to the PCBs measured in the surface water at the site. The increase in total PCB concentrations upstream of the contaminated sediments in the Dam impoundment area and localized increase in certain PCBs homologues behind the dam are illustrated in Figure 4.

3.2.2 Semi-permeable Membrane Device (SPMD) Results

SPMDs placed in the water-column support the interpretation that PCB 11 is entering the river upstream of the sediment deposits. The SPMD results from the devices placed one meter over the bottom sediment deposits also demonstrate a shift in PCB congeners which is consistent with the congener profile seen in the sediment in Deposit 1. The SPMDs were deployed at three stations along the Upriver Dam PCB site. Specifically, SPMDs were deployed at Plante's Ferry Park, Boulder Beach, and in the Dam Forebay during the summer low flow and fall precipitation sampling intervals.

A comparison of SPMD-based semi-quantitative dissolved PCB concentration estimates with corresponding total PCB concentrations from direct water sampling at the same stations and over the same time frame support the conclusion that total PCB concentrations in the waters of the Spokane River increase as the river flows through the Deposit 1 area under low-flow conditions. The increases in PCBs appear to be attributable to a combination of locally treated wastewater releases of PCB-11 between Plante's Ferry Park and Boulder Beach and releases of dissolved PCBs from the sediment deposits behind the Upriver Dam. The SPMD data further corroborate that, on a river reach scale, concentrations of both dissolved and total PCBs were below the 170 pg/L water quality standard but above the National Recommended Criterion of 64 pg/L under the seasonal low flow conditions sampled. The SPMD results also corroborated a number of other PCB fate and transport characteristics at the Site, including:

- A common shift in predominant dissolved PCB congener homologue groups or individual congeners between Boulder Beach and the Upriver Dam.
- An apparent increase in dissolved PCB concentrations at depth near Boulder Beach, likely due to a combination of wastewater sources and potential sediment releases.

3.3 Groundwater

All results indicate that the PCBs in groundwater are significantly below the MTCA Method B groundwater cleanup level of 500,000 picograms per liter [pg/L] based on the state and federal drinking water maximum contaminant level [MCL]), and below the Method B level for groundwater of 44,000 pg/L required to meet the maximum one in a million lifetime cancer risk. Average and maximum results were 23 and 70 pg/L, respectively, in the May samples. In September, average and maximum results were 63 and 116 pg/L, respectively. The associated blanks ranged from 10 to 226 pg/L.

As discussed in Section 4.2.3, down-gradient groundwater total PCB concentrations measured during the focused RI sampling were similar to area background surface water PCB concentrations measured upstream of fine-grained sediment deposits at Boulder Beach. Maximum groundwater PCB concentrations were also substantially (more than 4,000-fold) lower than drinking water-based groundwater cleanup levels. Thus, the groundwater results are consistent with river surface water conditions.

3.4 Contaminants and Media of Concern

The purpose of this discussion is to present a summary of identified Chemicals of Potential Concern (COPCs) within Upriver Dam sediments based on characterization data collected to date at the Site, consistent with Ecology's goal of establishing cleanup levels at sediment concentrations that minimize adverse effects, as described in the Sediment Management Standards (SMS: WAC 173-204). Freshwater sediment screening levels used for COPC identification were based on the lowest apparent effects thresholds (LAETs), as updated in Ecology's Freshwater Sediment Quality Value (SQV) development document (Michelson 2003) which includes sediment quality values for a wide range of metal and organic chemicals.

The frequency of exceedance of updated LAET-based screening levels in Upriver Dam sediments on a broad area-wide scale, based on the cumulative RI data collected at the Site, is summarized below. Of all chemicals analyzed in site sediments, metals exceeded the LAET values most frequently. However, as discussed in Section 2.0, the EPA is the lead agency responsible for remedial actions related to wide-spread elevated heavy metals that have been deposited within the watershed. PCBs were the next class of chemicals that most frequently exceeded guidance values set for freshwater sediments, exceeding the draft LAET values in 13 percent of all samples collected under the RI. Sediments exceeding adverse effects thresholds primarily occurred within the known fine-grained deposit located directly upstream of the Dam along the northern bank of the river (Deposit 1) and along a relatively small area in the backwater channels near Donkey Island (Deposit 2). Wood waste and associated degradation products such as retene were also detected in the fine-grained deposit at concentrations above updated LAETs. An initial ranking of COPCs in Upriver Dam sediments, based on the relative frequency of exceedances above the draft LAET screening guidance and presence at Deposits 1 and 2, are summarized in Table 1.

Chemicals of Potential Concern (COPC)s Exceedances in Sediments of the Spokane River PCB Site	
COPCs	Frequency of LAET Guidance Value Exceedances
Zinc	69.6%
Cadmium	56.5%
Lead	30.4%
PCBs	13.0%
Arsenic	4.3%
Retene	4.3%
Total Organic Carbon (TOC)	4.3%

Table 1 Chemicals of Potential Concern (COPCs) and the relative frequency of exceedances identified at the Site

In 2000, sediment toxicity was evaluated at various locations along the Spokane River, including at Deposit 1, using a suite of acute and chronic sediment toxicity bioassays (Johnson and Norton 2001). Laboratory bioassays performed on the Site sediments show evidence of acute and chronic toxicity. The two samples collected in the vicinity of Upriver Dam, from the area designated as Deposit 1, exhibited sediment toxicity significantly greater than the reference samples. Although a suite of contaminants in the Site's sediment are likely to have contributed to the bioassay failures, data indicate that the existing concentrations of PCBs at Deposit 1 are at levels that may independently cause bioassay failures. As discussed previously, surface sediments located primarily in the two fine-grained sediment deposits, Deposit 1 and 2, exceed draft LAET screening levels for potential PCB toxicity in freshwater environments (Michelsen 2003).

This FCAP is focused on remedial activities associated with PCB-containing sediment at the Site. However, in the context of developing appropriate cleanup levels and response actions that recognize all COPCs at the Site, Ecology also considered the relationship of potential risks and remedies relevant to other co-occurring hazardous substances. All planned remedial cleanup actions will effectively eliminate the risks posed by the PCBs found behind the Upriver Dam and, incidentally, will be consistent with actions that are effective at reducing risks from the other COPCs. PCBs in fish from the upper Spokane River, which includes the Upriver Dam PCB Site, have been documented at concentrations well above the National Toxics Rule (NTR) criterion. Tissue concentrations are high enough to warrant no-consumption advisories for fish caught at the Site (See Section 4.2). Cleanup Actions selected by Ecology must meet the criteria set forth by WAC 173-340-360 and must be protective of both human health and the environment.